

Coasting on Energy

In this chapter, you will be studying energy conversion, friction, and the law of conservation of energy. This project will help you to understand these concepts by allowing you to apply them to something that may be familiar to you—roller coasters. Have you ever ridden a roller coaster? Did you find the ride exciting or scary? Why? What happens to the speed of a roller coaster as it goes uphill, downhill, or through a turn? What features of roller coasters make them fun—giant hills, fast turns, vertical loops? If you were to design your own roller coaster, what features would you include?

In this project you will have the opportunity to create your very own roller coaster. Your vehicle will begin its journey on top of a hill that is no more than one meter in height. (Think about the potential energy in that vehicle!) It must then travel the full length of your track, climbing over two additional hills, without stopping or falling off the track. Once you have successfully created this basic roller coaster, you will modify your track to include the more complex features, like turns and/or vertical loops.

Project Rules

- Your first hill may not be higher than one meter in height.
- Your vehicle must complete the entire track without stopping or falling off. Once you have placed your vehicle on top of the first hill, you cannot add any energy to the system to help your vehicle complete its route.
- Before you begin building your roller coaster, you must write out design plans that include the materials you plan to use, and a sketch (drawn to scale) of your basic roller coaster track. Your teacher must approve these plans.
- You must make several modifications to your track. The first set of modifications will be to determine the maximum height possible for your second and third hills. The second set of modifications will be to add turns and/or vertical loops to your track.
- You must keep detailed records of any modifications that you make to your track, including the success of your vehicle's trial runs.
- You must be able to apply key terms such as kinetic energy, potential energy, and energy transformation to the description of your roller coaster.
- You must present your roller coaster to the class. During this presentation, you will have to describe all modifications that you made to your roller coaster. You will also have to show your understanding of energy conversion, friction, and the law of conservation of energy.

Part 1: Planning Your Roller Coaster

Sketch a diagram of your roller coaster. On the sketch of your roller coaster, indicate the following: Height of each hill, Distance between hills, Point of maximum potential energy.



1. What materials will you be using to build your track? How will you secure your track in place?
2. What do you plan to use as your vehicle? How will your vehicle be affected by friction?

Part 2: Finding the Maximum Hill Heights

Create a chart similar to the one below to record all modifications that you make to your track.

1. How did changing the height of the second hill affect the distance that your vehicle traveled up the third hill?

Modification (Changes)	Why was the change made?	How did this improve the track?

2. How did changing the distance between hills affect your vehicle's performance?

3. What was the maximum hill height that you found for your second and third hills?

Part 3: Adding Twists

Twist or Turn	Improve or not?	Challenges?

4. How did the placement of your turn or vertical loop affect the success of your vehicle in completing the track?

5. How did adding turns and loops to your track affect your vehicle's performance on the hills?

6. What problems did you encounter in making these modifications? (For example, did you have to create a barrier to keep your vehicle from leaving the track on a sharp turn?)

Rubric: Paper Roller Coaster

Design

(15 points)

- Orthographic Projection was used for sketch
- First hill is no higher than a meter
- Includes three hills at least
- Includes at least one twist or turn

Presentation

(20 points)

- Orthographic Projection is included
- Modifications and details about why
- How roller coaster demonstrates Energy transfer, friction, gravity, & the law of conservation of energy.

Demonstration

(10 points)

- Vehicle completes entire track without falling or stopping
- Roller coaster doesn't bend or move when used

Writing Mechanics:

(5 points)

- No spellings mistakes
- No grammar mistakes